

Master of Science in Sustainability Management

SUMA PS5162 Responsiveness and Resilience in the Built Environment

Scheduled Meeting Times: TBD

Number of Credits (3)

Elective

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Office Hours: By appointment

Response Policy: Mondays 12:20-2:30 pm or upon request, 2929 Broadway, 5th Floor

Facilitator/Teaching Assistant: TBD

Office Hours: TBD

Response Policy: TBD

Course Overview

Ask a layperson to define “resilience” and you may hear a response that focuses on the capacity to recover from disaster. Another might focus instead on the capacity within regular conditions to absorb an unanticipated shock. Both definitions – recovery and bandwidth – are correct, although each references different values placed on what constitutes status quo. Resilience can also refer to an individual, a society, a physical environment, a nation or a species. This course will begin with these definitions, then move on to considering how the built environment can serve to support multiscale resilience as well as a sustainability agenda. It will consider solutions that encourage social equity, make economic sense and can be tailored to the myriad environmental hazards that our increasing encroachment on a changing natural context produce.

A sustainable and resilient built environment is part of a dynamic system. Conventional infrastructure and buildings have aimed to hold back or transform the non-anthropogenic forces around it. In this course, we will work to understand how manmade conditions can also accommodate and adapt to changing environmental conditions, especially those that have the potential to destroy. We will discuss solutions that allow us to be **responsive and adaptive** to change. 21st century civic infrastructure can contribute to improving the way cities respond to long-term and catastrophic climate events while also enhancing their citizens’ daily lives. We will study techniques and conditions contributing to this change in approach, and have the opportunity to apply our findings in a concrete setting.

In past iterations of this course, students have developed solutions for sites in Brooklyn and Bronx, NY; New Rochelle, NY; Butte, Montana; Bridgeport, Ct; and Blue Island, Ford Heights and Robbins, Il. Last year, we looked at a site closer to us, Newark, NJ, and at the simultaneous challenges of urban heat island, energy insecurity, surface water and coastal flooding at the infrastructural crossroads of the US East Coast. This year, we will travel north to Providence, where we will collaborate with students in the Architecture Department at Rhode Island School of Design to explore four distinct resource flows that are vital to the city but are currently subject to reinvention relative to mitigation of climate change impacts and adaptation to climate change. As always in this course, issues of environmental equity and civic opportunity will be foregrounded. A weekend workshop will inaugurate the projects that this class will complete over the semester.

The purpose is to envision what is needed for our physical environment to attain and maintain **resilience**, from the scale of the person all the way up to the scale of regional infrastructure. We will also consider the cultural shifts required for urban systems to become sustainable. And we will ask fundamental questions about how resilience and sustainability can be made relevant to social, spatial and technological approaches to the physical world. This class will also teach you how to visualize, diagram and convey these vital ideas.

Learning Objectives

Upon successful completion of this course students should be able to:

- Describe the basic concepts by which the legacy-built environment functions and how 21st century infrastructure could differ to enhance resilience and improve environmental justice deficits;
- Understand and use the terms that govern our discourse on both sustainability and resiliency in the built environment;
- Describe the ways material, water, energy, labor and cultural practice interact with and upon the built environment;
- Understand current models for assessing, benchmarking and communicating sustainability and resiliency of the anthropogenic environment;
- Use creative methods to communicate outcomes and propose alternatives to standard practices in managing the built environment;
- Develop and use highly effective visual communication techniques.

Course Structure

This course will ask you to engage actively as well as providing information through lectures and readings. The work includes class discussion, student presentations, longer-term group research projects, in-class lab time (to confer with Professor Widder, our TA Camille McGriff, and other student groups), and an elective weekend design workshop conducted with the Department of Architecture at Rhode Island School of Design. Outside experts will occasionally lecture. All that you learn will be leveraged in your final group design project for Providence, RI.

Urban Systems and their Sites

There are general, consensual definitions and practices that accrue to resilience, and we will consider these in our readings and lectures. But when considering a specific place and its hazards, specificity is necessary. This semester, we are considering how one city, Providence, deals with its flows of materials and wastes; how its systems can be improved for lesser climate impact (mitigation); how the locations and means of flows can help to respond to climate change challenges (adaptation and resilience); and how to realize potentials of urban systems for their capacity to deliver on promises to the people who depend on them.

Providence is unusual in its side-by-side of working waterfront and neighborhood water access, and for its importance in regional material logistics capacity while being a city whose economy is largely driven by education, healthcare and financial services. It is, demographically, among the most integrated cities in the region but inequalities persist. Each group will deal with the challenges facing the waterfront – storm surge, stormwater, privatization, waterfront access, commercial viability, water quality, to name a few – while thinking about the role that a specific set of sites along the harbor play for the stakeholders that converge there. Some of the potential collaborators and flows to be considered are listed below:

- Organic Waste: in collaboration with Groundwork RI (see this article on their [composting](#))
- Petroleum Products: in consultation with Global ProvPort (see this brief overview of [Global Partners](#))

· Storm Water: in collaboration with the Rhode Island Department of Environmental Management (see this description of [the facility at Field's Point](#))



Field's Point Area and Adjacent Communities

To launch these projects, we have organized a two-day workshop in collaboration with Rhode Island School of Design. During the workshop, groups of students, combining Columbia and RISD architecture students, will consider these resource flows and the sites they impact. The workshop take place in Providence. There, we will meet with government officials and planners, community activists and representatives and elected officials; then work towards initial proposals for all three sites. Travel to and from the city will be via Amtrak, departing New York either on Thursday evening or first thing Friday morning, depending on group preference. All expenses while in Providence, including meals (but not including any alcoholic beverages) will be covered by a grant from the Climate School. The approaches proposed will form the basis for the work in this class for the rest of the semester. We have selected Friday October 4 - Saturday October 5 for the workshop.

Additional information and a full schedule will be shared in advance of the workshop. Participation is encouraged but it is voluntary.

Coursework, Evaluation, Academic Integrity

Readings and Written Discussions (individual assignment, 20% of grade, each reading discussion is approximately 4-5% of total grade i.e +/- ½ letter)

- **Part A:** students will post responses to readings based upon the reading guides provided to CourseWorks no later than 11:00 AM on the day of class.
- **Part B:** students are expected to be prepared for active, intelligent participation in in-class discussions. Participation will be tracked and evaluated for consistency and quality.

NB: If you cannot attend a class, it is your responsibility to communicate your absence no later than 9:00 AM on the day of class in the case of illness or a week in advance in the case of other personal or business conflicts. Neglecting to do so will mean you will not receive credit for the reading/discussion portion of that day's class.

“Students Have to Eat” (group assignment, 10% of grade)

Cook a meal together. Quantify and track material, labor, energy and waste; then diagram the meal's production and consumption. A separate assignment sheet will be on Courseworks.

Precedent Studies (group assignment, 30% of grade)

Work in new groups of 3-5 to research one of the assigned case studies into both small scale and large scale resilient urban infrastructure and architecture. A separate assignment sheet will be available and includes a template for submission. Results will be presented during class by each group and posted to CourseWorks.

Resilient Community Term Project (group assignment, 40% of grade)

Urban systems design and proposal; working in groups of 3-5, you will develop integrated strategies for development and revitalization of our sites in Baltimore. The proposals developed during the workshop will form the basis for each group's approach. Lab time in the second portion of the semester will be used for interactive consultation with Professor Widder and TA Camille McGriff.

Grading Criteria

The criteria for grading will value deep, open-minded engagement with course material. Active class participation is expected, as well as evidence of solid preparation and willingness to invest personal expertise into group work. The work submitted should be graphically clear and free of careless errors.

For example, your term projects will be graded using the following rubric:

- research evidence – 20%
- analysis – 20%
- synthesis and mission statement – 10%
- thoughtful presentation – 20%
- creativity and integrative thinking – 30%

Feedback on projects will include both letter grades and comments to help you consistently improve performance through the semester. However, final work may not be redone and resubmitted for a new grade. Requests for extensions will only be granted if made in advance and warranted by extenuating circumstances (e.g., sickness, personal or family matters). Failure to submit an assignment will result in an F for that portion of the grade. Plagiarism is an academic offense that will result in automatic failure for the course; use of bots or AI to generate assignments is tantamount to plagiarism. Grading concerns and clarifications can be discussed through email or during office hours. Written submissions will be subject to a plagiarism check.

Readings

Required readings are listed in the schedule below. In addition to The Community Resilience Reader, other readings are required and all are provided on CourseWorks. Please prepare answers to the questions your colleagues write on each reading, and have the readings (paper or digital) available for reference during class. Supplemental optional readings (listed after the schedule, below) are available in the library, on CourseWorks or via hyperlink.

PART I – Overview and Central Concepts: Understanding the Physical Dimensions

Lecture and discussion of readings – Lecture and Discussion of Readings

Class 1

Lecture – Where, Not What: Resilience and The Physical Dimensions of Sustainability

Assignment – Mapping exercise ‘Students Have to Eat’ will be initiated

Listen

- On the Media: Apocalypse Now
<https://www.wnycstudios.org/podcasts/otm/episodes/on-the-media-2017-07-07> An amazing set of “science fiction” stories about climate change and human settlement.
- Marketplace: How We Survive <https://www.marketplace.org/shows/how-we-survive/> A series of podcasts on the energy transition – and more science fiction

Class 2

Lecture – Settlements and Agglomerations: legacy and new, systems and stand-alones

Readings

- Raven Cretney, ‘Resilience for Whom? Emerging Critical Geographies of Socio-ecological Resilience,’ *Geography Compass* (2014) 8/9: 627-640 (on Canvas)
- Daniel Lerch, Ed., *The Community Resilience Reader* (Washington: Island Press, 2017), Introduction and Chapter 9, ‘A Crash Course in the Science of Resilience
- Maxwell Woods, ‘“Stop Calling Me Resilient”: Addressing Environmental Degradation in Louisiana’, *Edge Effects*, May 9, 2017 updated October 12, 2019 [link](#)’
- Anya Groner, ‘[Between Worlds](#)’, in: *Orion* April 11, 2019 (optional read)

Listen

- Nature: the next big thing in climate adaptation technology? Jul 18, 2019
<https://www.marketplace.org/shows/marketplace-tech/nature-the-next-big-thing-in-climate-adaptation-technology/>

Assignment – Mapping exercise ‘Students Have to Eat’ continues, student add/drop accommodated.

Class 3

Discussion – Sacrificial Landscapes

Readings

- Adrian Parr, *Hijacking Sustainability* (Cambridge: MIT Press, 2009), Ch 6 ‘Trash’ pp 95-107
- Chloe Ahmann, ‘It’s Exhausting to Create an Event Out of Nothing: Slow Violence and the Manipulation of Time’, *Cultural Anthropology* (2018) v.33, n.1: 142-171
- Daniel Lerch, Ed., *The Community Resilience Reader* (Washington: Island Press, 2017), Chapters 12 ‘Building Resilience at the Water’s Edge’, 16 ‘Resilient Streets, Resilient Communities’ and 17 ‘Community Resilience and the Built Environment’
- Karen Russell, ‘The Gondoliers’, from *Orange World* (New York: Knopf, 2019)

Submittals for Presentation, by 11:00 AM – Results of ‘Students Have to Eat

Assignment – Precedent Studies in anticipation of term project will be initiated

PART II - Resilience and Sustainability at the Building and Settlement Scale: Self-Reliance or Networked? -
Lectures and Lab Time

Class 4

Lecture – Systems Integration, Shrinkage, Growth and Symbiosis

Readings

- Daniel Lerch, Ed., *The Community Resilience Reader* (Washington: Island Press, 2017), Chapter 7 ‘Systems Literacy: A Toolkit for Purposeful Change’
- Brett Milligan, ‘Landscape Migration,’ *Places Journal*, June 2015.
<https://placesjournal.org/article/landscape-migration/?cn-reloaded=1> (or on CourseWorks)
- Lovisa Harfeldt-Berg, ‘Distribution of benefits and adverse effects and their role in industrial symbiosis decision-making – A Swedish case study,’ *Cleaner Environmental Systems* 13 (2024). (on CourseWorks)

Lab Time – Precedent Studies in anticipation of term project

Class 5

Debrief – Workshop Results discussion

Lecture – David Waggoner + Andrew Sternad (Waggoner and Ball/Moffatt & Nichol)

Readings

- David Waggoner, 'Learning to Live with Water'
- [Alexander von Humboldt, excerpt *Views of Nature*](#) (or log on to Clio, then search 'Views of Nature'. This is a book by the 19th century explorer and naturalist Alexander von Humboldt. Read the two author prefaces and then leaf through the plates and skim the text for the rest of the book. Important is the way Humboldt thinks and writes about what he has seen.)
- [Thomas Merton, *The Way of Chuang Tzu*](#) (this is a preview of Thomas Merton's *The Way of Chuang Tzu*. please read 'A Note to the Reader' and '1. A Study of Chuang Tau)

· **Lab Time** – Precedent Studies in anticipation of term
project

Class 6

Lab Time (by appointment with Professor and TA outside of class time) – Develop hypothesis, develop visualization concept, develop design proposal

Lecture – Nani Kauz Apolo, WXY Studio, New York

Readings – tbd

Class 7

Submittals for Presentation, by 1:00 PM – Precedent Study slide decks

Assignment – Providence term project initiated

Class 8

Lecture – Energy, at Urban, Building and Infrastructure Scale

Readings

- Bill Bryson, *At Home: A Short History of Private Life* (New York: Anchor Books, 2011), Ch VI 'The Fuse Box' pp 131-159 (on CourseWorks)
- Herbert Murray, '[Machines in the Garden](#)', in *Places Journal* January 2022
- Daniel Lerch, Ed., *The Community Resilience Reader* (Washington: Island Press, 2017), Chapter 11 'Energy Democracy'
- Diana Hernández, 'Sacrifice Along the Energy Continuum: A Call for Energy Justice', in *Environmental Justice*, v. 8, No. 4, 2015 p. 151=156

No Class

Optional Lab Time (by appointment with Professor and TA outside of class time) –Develop visualization concept, develop design proposal.

PART III – Findings and Proposals, Term Project - Lectures and Lab Time

Class 9

Submission for Presentation, by 1:00 PM – Mid-project presentation; guest discussants

- TBD

Submittals – Proposal slide decks

Class 10

Lecture – Urban Metabolism, City History through Resource Flows

Readings

- Christopher Kennedy et al., ‘The Changing Metabolism of Cities,’ *Journal of Industrial Ecology*, (2007) 11/2: 43-59
- Christopher Kennedy, *The Evolution of Great World Cities: Urban Wealth and Economic Growth* (Toronto: University of Toronto Press, 2011), Ch 6 ‘The Ecology of Urban Economies’ pp 139-166
- Haberl, Fischer-Kowalski, Krausmann, Martinez-Alier, Winiwarter, ‘A Socio-metabolic Transition towards Sustainability? Challenges for Another Great Transformation’, *Sustainable Development* (2011) 19, 1-14

Class 11

Guest Lecture – TBD

Readings

- tbd

Optional Lab Time (by appointment with Professor and TA outside of class time)

–Develop visualization concept, develop design proposal.

Class 12

Lab Time – Consultations with Professor and TA

Class 13

Submittal for Presentation, until 5:00 PM – Final term project presentations; guest discussants.

- TBD

Final Submissions Due

Submittals – Final term project slide decks and any revised work you would like reconsidered for grading.

Readings (in library or upon demand unless website is noted)

Topic: Providence

- Providence Climate Justice plan
<https://www.providenceri.gov/sustainability/climate-justice-action-plan-providence/>
- On the benefits of waterfront access and its difficulties in Rhode Island
<https://www.frontiersin.org/journals/marine-science/articles/10.3389/fmars.2021.760684/full>
- On food access and urban planning in Providence
<https://openknowledge.fao.org/server/api/core/bitstreams/0f7b5e22-5f9d-4087-a4ce-46fdffd79060/content>
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- A history of the reciprocity between the industrial harbor and Narragansett Bay <https://link.springer.com/article/10.1007/s10113-011-0221-1>
- Providence Census and demographics <https://council.providenceri.gov/census-2020/>
- Providence historic map collection <https://www.rihs.org/map-collections/>
- Providence Office of Sustainability <https://www.providenceri.gov/sustainability/>
- Providence Resilience Partnership <https://providenceresilience.org/>
- Rhode Island Infrastructure Bank <https://www.riib.org/solutions/programs/municipal-resilience-program/>
- Resilient Rhody Strategy <https://planning.ri.gov/planning-areas/climate-change-resilience/adaptation>

Topic: Urban Resiliency Resources

- HUD 2015a, Harnessing Ecosystem Services for Water Management, Part 1, Overview of Floodplain Management, slide deck at: <https://www.hudexchange.info/course-content/ndrc-harnessing-ecosystem-services-for-water-management-webinar/Harnessing-Ecosystems-Services-for-Water-Management-Webinar-Slides-2015-01-08-Part-1.pdf>
- HUD 2015b, Harnessing Ecosystem Services for Water Management, Part 2, Structural Measures at a Glance, slide deck at: <https://www.hudexchange.info/course-content/ndrc-harnessing-ecosystem-services-for-water-management-webinar/Harnessing-Ecosystems-Services-for-Water-Management-Webinar-Slides-2015-01-08-Part-2.pdf>
- HUD 2015c, Harnessing Ecosystem Services for Water Management, Part 3, Permeable Pavement Parking, slide deck at: <https://www.hudexchange.info/course-content/ndrc-harnessing-ecosystem-services-for-water-management-webinar/Harnessing-Ecosystems-Services-for-Water-Management-Webinar-Slides-2015-01-08-Part-3.pdf>
- HUD 2015d, Critical Infrastructure Resilience Webinar at: <https://www.hudexchange.info/training-events/courses/critical-infrastructure-resilience/>
- HUD 2015e, Energy Investments for Disaster Resilience, slide deck at <https://www.hudexchange.info/course-content/energy-investment-for-disaster-resilience/Energy-Investments-for-Disaster-Resilience-Webinar-Slides-2015-02-03.pdf>
- HUD 2014a, Equity and Achieving Equitable Outcomes, slide deck at: <https://www.hudexchange.info/course-content/ndrc-equity-and-achieving-equitable-outcomes-webinar1/NDRC-Equity-and-Equitable-Outcomes-Slides-2014-11-04.pdf>
- HUD 2014b, Climate Adaptation Planning, slide deck at <https://www.hudexchange.info/course-content/ndrc-climate-adaptation-planning-101-webinar1/NDRC-Climate-Adaptation-Planning-Slides-2014-11-20.pdf>
- HUD 2014c, National Disaster Resilience Competition, Innovative and Inclusive Citizen Engagement Webinar at <https://www.hudexchange.info/training-events/courses/ndrc-innovative-and-inclusive-citizen-engagement-webinar/>
- IPCC 2011, Renewable Energy Sources and Climate Change Mitigation, report at <http://srren.ipcc-wg3.de/report>
- WRI 2005, Millennium Ecosystem Assessment, General Synthesis Report On Ecosystems And Human Well-Being, report at <http://www.millenniumassessment.org/documents/document.356.aspx.pdf>
- WWF 2011, The Energy Report- 100% Renewable Energy by 2050, report at http://wwf.panda.org/what_we_do/footprint/climate_carbon_energy/energy_solutions22/renewable_energy/sustainable_energy_report/

Topic: General Culture and History, Built Environment

(available through CLIO, at Avery or Butler Library)

- Cecil D. Elliott, *Technics and Architecture* (MIT Press: Cambridge, Ma and London, 1992): an historical overview of the production processes and technological advances over the course of construction history relative to both materials (wood, masonry, terracotta, metals, glass, cements, reinforced concrete), systems (lightning protection, sanitation, lighting, heating and ventilation, a/c, elevators, fire protection, structural engineering and acoustics), labor and technology.

<https://placesjournal.org/> Online journal covering architecture, landscape and urbanism in well-researched and unusual ways

- Andreas Huyssen, ed., *Other Cities, Other Worlds: Urban Imaginaries in a Globalizing Age* (Duke University Press: Durham and London, 2008): a fascinating set of essays on global cities and the cultural, economic and political imaginaries that drive their growth and perception

Assignments and Assessments

We meet once a week for just under two hours. During the first part of the semester, we will generally review readings and discuss questions for the first forty-five minutes of class, then spend the second portion of lectures, workshops and presentations of student work.

All in-class presentations must be submitted to CourseWorks by 11:00 AM on the day of the class in which the presentations will occur. You will upload under “assignments” (as attachment). We will repost your presentations to the files portion of the site for sharing.

In the latter part of the semester, we will devote more time to consultation and group discussion about your design proposals. Lectures at the beginning of the period will cover topics related directly to the term project, and the remainder of class will be dedicated to lab time and consultations. To aid review and discussion of your group’s term project, a panel of guest experts will be present during presentation of both your initial proposal and its ultimate iteration.

Special consideration of individual effort

Fair grading of group work has its challenges. If you would like your individual contributions considered for grading, it is your responsibility to document carefully both process and product, and submit it as detailed above. Your work documentation should include research notes, sketches, notes from brainstorming sessions, and your individual input into the group’s work. (If it’s more convenient, you can submit your course notebook, including any other class materials, as long as the work you want reviewed is clearly marked.)

School and University Policies and Resources

Copyright Policy

Please note—Due to copyright restrictions, online access to this material is limited to instructors and students currently registered for this course. Please be advised that by clicking the link to the electronic materials in this course, you have read and accept the following:

The copyright law of the United States (Title 17, United States Code) governs the making of photocopies or other reproductions of copyrighted materials. Under certain conditions specified in the law, libraries and

archives are authorized to furnish a photocopy or other reproduction. One of these specified conditions is that the photocopy or reproduction is not to be "used for any purpose other than private study, scholarship, or research." If a user makes a request for, or later uses, a photocopy or reproduction for purposes in excess of "fair use," that user may be liable for copyright infringement.

Academic Integrity

Columbia University expects its students to act with honesty and propriety at all times and to respect the rights of others. It is fundamental University policy that academic dishonesty in any guise or personal conduct of any sort that disrupts the life of the University or denigrates or endangers members of the University community is unacceptable and will be dealt with severely. It is essential to the academic integrity and vitality of this community that individuals do their own work and properly acknowledge the circumstances, ideas, sources, and assistance upon which that work is based. Academic honesty in class assignments and exams is expected of all students at all times.

SPS holds each member of its community responsible for understanding and abiding by the SPS Academic Integrity and Community Standards posted at <https://sps.columbia.edu/students/student-support/academic-integrity-community-standards>. You are required to read these standards within the first few days of class. Ignorance of the School's policy concerning academic dishonesty shall not be a defense in any disciplinary proceedings.

Diversity Statement

It is our intent that students from all diverse backgrounds and perspectives be well-served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that the students bring to this class be viewed as a resource, strength and benefit. It is our intent to present materials and activities that are respectful of diversity: gender identity, sexuality, disability, age, socioeconomic status, ethnicity, race, nationality, religion, and culture.

Accessibility

Columbia is committed to providing equal access to qualified students with documented disabilities. A student's disability status and reasonable accommodations are individually determined based upon disability documentation and related information gathered through the intake process. For more information regarding this service, please visit the University's Health Services website: <https://health.columbia.edu/content/disability-services>.

Class Recordings

All or portions of the class may be recorded at the discretion of the Instructor to support your learning. At any point, the Instructor has the right to discontinue the recording if it is deemed to be obstructive to the learning process.

If the recording is posted, it is confidential and it is prohibited to share the recording outside of the class.

SPS Academic Resources The Division of Student Affairs provides students with academic counseling and support services such as online tutoring and career coaching: <https://sps.columbia.edu/students/student-support/student-support-resources>.

[Columbia University Information Technology](#) (CUIT) provides Columbia University students, faculty and staff with central computing and communications services. Students, faculty and staff may access [University-provided and discounted software downloads](#).

Columbia University Library

[Columbia's extensive library system](#) ranks in the top five academic libraries in the nation, with many of its services and resources available online.

The Writing Center

The Writing Center provides writing support to undergraduate and graduate students through one-on-one consultations and workshops. They provide support at every stage of your writing, from brainstorming to final drafts. If you would like writing support, please visit the following site to learn about services offered and steps for scheduling an appointment. This resource is open to Columbia graduate students at no additional charge. Visit <http://www.college.columbia.edu/core/uwp/writing-center>.